Trauma-Related Symptoms in Veterans of Operation Desert Storm: A 2-Year Follow-Up

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Objective: *This study was a 2-year follow-up in an ongoing prospective examination of development of trauma-related symptoms over time in a community group of veterans of Operation Desert Storm.* *Method:* *Sixty-two National Guard reservists, from one medical and one military police unit, completed the Mississippi Scale for Combat-Related Posttraumatic Stress Disorder and a DSM-III-R-based posttraumatic stress disorder (PTSD) symptom scale 1 month, 6 months, and 2 years after returning from the Middle East. Differences in symptom severity over time were analyzed by using repeated measure analyses of variance.* *Results:* *Scores on the Mississippi scale, but not the DSM-III-R PTSD scale, increased significantly over time. Symptoms of hyperarousal were more severe at all time points than were symptoms of reexperiencing or avoidance. Level of combat exposure, as reflected by the Desert Storm trauma questionnaire, was significantly associated with the score on the Mississippi scale at 2 years but not at 1 month or 6 months. All subjects who met the Mississippi scale's diagnostic criteria for PTSD at 1 or 6 months still met the criteria at 2 years.* *Conclusions:* *Although symptoms were relatively mild, there was an overall increase in PTSD symptoms over 2 years. The statistical relationship between level of combat exposure and PTSD symptoms at 2 years, and not before, suggests that it may take time for the consequences of traumatic exposure to become apparent. Moreover, degree of exposure may be important in predicting the eventual development of symptoms. Continued follow-up will address the evolution of PTSD symptoms in Gulf War veterans.*

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Although posttraumatic stress disorder (PTSD) is common, relatively little is known about its natural history. Cross-sectional descriptive studies have made it clear that stress-related symptoms often cause problems even decades after a catastrophic event. For example, Goldstein et al. (1) reported a PTSD prevalence of 50% in former World War II prisoners of war 40 years after imprisonment. Additionally, in a community group of Vietnam theater veterans, Kulka et al. (2) found that 15% met diagnostic criteria for PTSD nearly 20 years after the war. Chronic trauma-related symptoms also have been reported in survivors of the Holocaust (3–5), natural disasters (6, 7), accidents (8, 9), and violent crime (10, 11).

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While cross-sectional studies are highly informative, they are not designed to investigate the natural course of a disorder. Similarly, retrospective approaches are subject to inaccurate recall. Prospective studies, on the other hand, are ideal for collecting detailed information about the evolution and course of psychiatric symptoms and syndromes.

Prospective investigations of traumatized populations, although limited in number, have generally shown a decrease in psychological symptoms over time. In a study of the Buffalo Creek Dam disaster, Green et al. (12) noted a decrease in the prevalence of PTSD from 44% to 28% over 12 years. A decrease in psychopathology also was found among survivors of the Beverly Hills Supper Club fire (8). Of note, however, most studies have shown a waxing and waning of symptoms, rather than a steady increase or decrease. For example, Kinsie (13) described an ongoing sensitivity in Southeast Asian refugees, who had become less symptomatic over time but who tended to experience a return of their entire PTSD syndrome under conditions of stress.

To better understand the pattern and sequence of

symptom development in victims of trauma, several years ago we began to follow a community group of 84 soldiers from two National Guard units who had served in Operation Desert Storm; the evaluations began shortly after the soldiers' return from the Middle East. In a preliminary publication (14) we reported findings from psychosocial evaluations at 1 month and 6 months after the war. Between 1 month and 6 months scores on the Mississippi Scale for Combat-Related Posttraumatic Stress Disorder increased significantly. Symptoms of arousal were more severe than symptoms of reexperiencing or avoidance at both time points. Further, level of combat exposure was significantly associated with the level of PTSD symptoms as reflected by the Mississippi scale score.

The present report is a continuation of our prospective longitudinal study of Desert Storm veterans. Sixty-two of the 84 subjects who completed psychosocial evaluations at both 1 month and 6 months also completed the evaluation 2 years after the war. We now report on the results of this 2-year evaluation.

METHOD

The methods for this study were the same as those described in the preliminary report on returning Desert Storm veterans (14). Of the 84 subjects who completed the questionnaire at 1 month and 6 months, 62 also completed it at 2 years. They were from a medical unit (N=30) and a military policy unit (N=32) and included both men (N=49) and women (N=13). After the procedures, risks, and benefits of the study were fully explained, all subjects gave written informed consent.

The questionnaire included a PTSD symptom scale based on the DSM-III-R criteria (14). The subjects rated the following 17 DSM-III-R symptoms: intrusive memories, nightmares, flashbacks, feeling worse with war reminders, avoidance of thinking about war, avoidance of war reminders, amnesia with respect to war, decreased interest in important activities, feeling cut off from other people, feeling less strongly about things, emotional numbness, sleep disturbance, irritability, decreased concentration, being watchful or on guard, increased startle, and reactivity to war reminders. The symptoms were analyzed as individual items and as members of the three symptom clusters in DSM-III-R: reexperiencing, avoidance, and hyperarousal.

Degree of severity over the preceding month was rated for each symptom on the following scale: 0 (not at all), 1 (slightly), 2 (moderately), 3 (considerably), or 4 (extremely). A total PTSD score was calculated by summing the values for each symptom; a total score of 68 was possible. The independence of time (1 month versus 2 years, 6 months versus 2 years) and symptom severity (<2 versus ≥2) was tested by using a matched-pairs chi-square analysis (McNemar's test) for each of the 17 symptoms.

The questionnaire also included the Mississippi Scale for Combat-Related Posttraumatic Stress Disorder (15) (range=35–175), the Combat Exposure Scale (16) (0–8=light exposure, 9–16=light to moderate, 17–24=moderate, 25–32=moderate to heavy, and 33–41=heavy), and the Desert Storm trauma questionnaire. The Mississippi Scale for Combat-Related Posttraumatic Stress Disorder is a self-report inventory consisting of 35 items derived from DSM-III and associated features. It measures both symptom severity and the effects of symptoms on an individual's life. The Combat Exposure Scale is a subjective scale that quantifies wartime stressors.

The Desert Storm trauma questionnaire (14) is composed of 19 items dealing with stressors that, although sometimes overlapping, are not specifically included in the Combat Exposure Scale but were experienced by many Desert Storm personnel. These include extreme threat to personal safety, seeing others killed or wounded, death of a close friend, sitting with the dying, being stationed close to enemy lines, and witnessing bizarre disfigurement of bodies as a result of wounds. The total score is the number of positive responses, and the possible range is 0 to 19.

Changes over time in Mississippi scale and total PTSD scores were investigated by using repeated measures analyses of variance in which time was the within-subject factor and gender and unit were the between-subjects factors. Differences in scores by unit (medical versus military police) and gender at each time point were determined as part of this analysis. Interactions between time and the two between-subjects factors were used to indicate whether changes in scores differed significantly between the two units or between genders.

Finally, the relationships of the Mississippi scale score to scores on the Combat Exposure Scale and on the Desert Storm stressor questionnaire were tested by using linear regression, with adjustment for age, gender, unit, and race.

RESULTS

The number of subjects endorsing each of the DSM-III-R PTSD symptoms with a rating of 2 (moderate severity) or greater is shown in table 1 (at 1 month and 2 years) and table 2 (at 6 months and 2 years).

Three of the four most frequently endorsed symptoms at 1 month were increased startle (27%, N=17), irritability (18%, N=11), and sleep disturbance (16%, N=10), all of which are included in the hyperarousal symptom cluster of DSM-III-R. The other symptom most frequently endorsed was intrusive memories (16%, N=10). At 6 months the most frequently endorsed symptoms were irritability (40%, N=25), intrusive memories (31%, N=19), startle (27%, N=17), sleep disturbance (21%, N=13), and decreased concentration (21%, N=13). At 2 years the most frequently endorsed symptoms were intrusive memories (31%, N=19), startle (26%, N=16), sleep disturbance (26%, N=16), and irritability (24%, N=15).

When the PTSD symptoms were combined into three clusters, hyperarousal had a significantly higher mean value at all time points than did either the reexperiencing cluster ($t=-4.15$, $df=61$, $p<0.0001$ at 1 month; $t=-2.17$, $df=61$, $p<0.05$ at 6 months; $t=-3.70$, $df=61$, $p<0.001$ at 2 years) or the avoidance cluster ($t=-3.96$, $df=61$, $p<0.0005$ at 1 month; $t=-3.29$, $df=61$, $p<0.005$ at 6 months; $t=-2.58$, $df=61$, $p<0.05$ at 2 years). The reexperiencing and avoidance symptom clusters were not different from each other at any time point.

We observed a statistically significant association between time (1 month compared to 2 years) and severity of both intrusive memories and reactivity to war reminders (table 1); more subjects reported at least moderate severity of these symptoms at 2 years than at 1 month. When 6 months was compared to 2 years (table 2), an association between time and severity of irritability was observed: fewer subjects reported moderate or greater severity at the 2-year time point.

The Combat Exposure Scale scores ranged from 0 to 38, with a mean of 6.85 (SD=6.57). The total score on the Desert Storm trauma questionnaire ranged from 0 to 8; the mean was 3.10 (SD=2.43). The mean Mississippi scale score was 57.60 (SD=12.31) at 1 month, 63.63 (SD=14.60) at 6 months, and 66.54 (SD=14.68) at 2 years.

TABLE 1. Severity Ratings[a] for 17 DSM-III-R PTSD Symptoms by 62 Veterans of Operation Desert Storm 1 Month and 2 Years After Their Return to the United States

Symptom	Number of Subjects				χ^2 (df=1)[b]
	Rating ≥2 at Both Times	Rating ≥2 at 1 Month, <2 at 2 Years	Rating <2 at 1 Month, ≥2 at 2 Years	Rating <2 at Both Times	
Reexperiencing cluster					
Intrusive memories	7	3	12	40	4.27*
Nightmares	1	3	4	54	0.00
Flashbacks	2	2	4	54	0.17
Feeling worse with war reminders	1	2	6	53	1.13
Avoidance cluster					
Avoidance of thinking about war	2	2	8	50	2.50
Avoidance of war reminders	2	2	4	54	0.17
Amnesia of war	1	2	8	51	2.50
Decreased interest in important activities	2	5	9	46	0.64
Feeling cut off from other people	3	6	9	44	0.27
Feeling less strongly about things	2	6	10	44	0.56
Feeling numb	3	0	5	54	3.20
Hyperarousal cluster					
Sleep disturbance	6	4	10	42	1.79
Irritability	8	3	7	44	0.90
Decreased concentration	4	4	9	45	1.23
Being watchful or on guard	4	5	9	44	0.64
Increased startle	7	10	9	36	0.21
Reactivity to war reminders	2	0	6	54	4.17*

[a]0=none, 1=slight, 2=moderate, 3=considerable, 4=extreme.
[b]Matched-pairs chi-square analysis (McNemar's test) with correction for continuity.
*p<0.05.

TABLE 2. Severity Ratings[a] for 17 DSM-III-R PTSD Symptoms by 62 Veterans of Operation Desert Storm 6 Months and 2 Years After Their Return to the United States

Symptom	Number of Subjects				χ^2 (df=1)[b]
	Rating ≥2 at Both Times	Rating ≥2 at 6 Months, <2 at 2 Years	Rating <2 at 6 Months, ≥2 at 2 Years	Rating <2 at Both Times	
Reexperiencing cluster					
Intrusive memories	10	9	9	34	0.06
Nightmares	2	3	3	54	0.17
Flashbacks	4	4	2	52	1.50
Feeling worse with war reminders	3	6	4	49	0.90
Avoidance cluster					
Avoidance of thinking about war	3	6	7	46	0.00
Avoidance of war reminders	2	8	4	48	2.08
Amnesia of war	3	3	6	50	0.44
Decreased interest in important activities	2	5	9	46	0.64
Feeling cut off from other people	5	6	7	44	0.00
Feeling less strongly about things	3	4	9	46	1.23
Feeling numb	4	3	4	51	0.00
Hyperarousal cluster					
Sleep disturbance	5	8	11	38	0.21
Irritability	12	13	3	34	7.56*
Decreased concentration	7	6	6	43	0.08
Being watchful or on guard	4	7	9	42	0.06
Increased startle	9	8	7	38	0.27
Reactivity to war reminders	3	2	5	52	0.57

[a]0=none, 1=slight, 2=moderate, 3=considerable, 4=extreme.
[b]Matched-pairs chi-square analysis (McNemar's test) with correction for continuity.
*p<0.05.

When a cutoff score of 89 or greater on the Mississippi scale was used as the criterion for a diagnosis of PTSD, two subjects met the criteria for PTSD at 1 month. In addition to these two, two more subjects met the criteria for PTSD at 6 months. These four and two more met the criteria for PTSD at 2 years. When the DSM-III-R criteria were used, four subjects met the criteria for PTSD at 1 month, four did so at 6 months, and

TABLE 3. Scores on a DSM-III-R-Based PTSD Scale and on the Mississippi Scale for Combat-Related Posttraumatic Stress Disorder of Veterans of Operation Desert Storm 1 Month, 6 Months, and 2 Years After Their Return to the United States

	Score on DSM-III-R-Based PTSD Scale						Score on Mississippi PTSD Scale					
	1 Month		6 Months		2 Years		1 Month		6 Months		2 Years	
Group	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Total (N=62)	7.85	8.37	11.03	10.10	11.87	10.26	57.60	12.31	63.63	14.60	66.54[a]	14.68
By unit												
Medical (N=30)	8.20	8.64	11.00	9.31	14.27[b]	11.24	57.53	12.92	63.07	14.04	69.58[c]	14.96
Military police (N=32)	7.53	8.23	11.06	10.93	9.63	8.83	57.66	11.91	64.16	15.32	63.69[d]	14.05
By sex												
Male (N=49)	7.37	8.17	10.24	9.77	10.92	9.38	56.90	11.67	62.57	14.40	65.54	13.89
Female (N=13)	9.69	9.18	14.00	11.16	15.46	12.84	60.23	14.70	67.62	15.26	70.31	17.46

[a]Significant overall effect of time (F=6.61, df=2, 116, p<0.002).
[b]Significant difference between units at 2 years (F=4.99, df=1, 58, p<0.03).
[c]Significant difference between units at 2 years (F=6.03, df=1, 58, p<0.02).
[d]Significant time-by-unit interaction (F=3.77, df=2, 116, p<0.03).

eight did so at 2 years. Four of these eight met the criteria for PTSD for the first time at the 2-year time point; the other four had diagnosable PTSD at 1 month, 6 months, or both.

Changes in PTSD and Mississippi scale scores are presented in table 3. A slight increase over time in total PTSD score in the group as a whole approached statistical significance (F=2.43, df=2, 116, p=0.09). No significant interaction between time and unit (F=2.37, df=2, 116, p=0.10) or between time and gender (F=0.05, df=2, 116, p=0.95) was observed.

On the other hand, the Mississippi scale score increased significantly over time (table 3). This change over time significantly differed between the medical and military police units. No difference in score by unit was observed at 1 month (F=0.23, df=1, 58, p=0.63) or 6 months (F=0.23, df=1, 58, p=0.64), although the medical unit had a significantly higher Mississippi score than the military police unit at 2 years (F=6.03, df=1, 58, p<0.02). The changes over time in the men and women were not significantly different (F=0.60, df=2, 116, p=0.55).

The greatest change in total score on the Mississippi scale occurred between 1 month and 6 months (F=18.83, df=1, 61, p<0.0005). Even though there was an increase in Mississippi scale score between 6 months and 2 years, it was not statistically significant. Similar results were observed with the total PTSD scale score; the score at 6 months was significantly different from the score at 1 month (F=10.00, df=1, 61, p<0.005) but not from the score at 2 years.

When the overall group was divided into the medical and military police units, the mean scores on both scales at 2 years were significantly higher in the medical unit (table 3), even though the mean total PTSD and Mississippi scale scores of the two units were similar at 1 month and 6 months. Of the original 84 subjects, 22 (11 from each unit) did not complete the 2-year evaluation. The dropouts from the medical unit were more symptomatic; they had higher mean total Mississippi scores than the medical unit completers at both 1 month (65.91 versus 57.53) (F=3.44, df=1, 39, p<0.08) and 6 months (71.45 versus 63.07) (F=2.19, df=1, 39, p<0.15). On the other hand, the dropouts from the military police unit had slightly lower mean Mississippi scores than the military police completers at 1 month (55.64 versus 57.66) (F=0.25, df=1, 41, p<0.62) and 6 months (59.64 versus 64.16) (F=0.84, df=1, 41, p<0.37).

There was no statistically significant relationship between Combat Exposure Scale and total Mississippi scale scores at 1 month, although this relationship approached statistical significance at 6 months (t=1.87, df=60, p=0.07) and 2 years (t=1.76, df=60, p=0.08). The total score on the Desert Storm trauma questionnaire was also found to be associated with the Mississippi scale score at 2 years (t=2.70, df=60, p<0.01) but not at 1 month or 6 months. The mean score on the Desert Storm trauma questionnaire was higher for the veterans in the medical unit than for those in the military police unit (4.77 versus 1.53) (F=48.79, df=1, 60, p<0.0005). While at 1 month and 6 months there was no relationship between traumatic exposure as measured by the Desert Storm trauma questionnaire and level of symptoms as measured by the Mississippi scale, the relationship was significant at 2 years. The correlation coefficients were 0.17 (df=60, p=0.19), 0.20 (df=60, p<0.12), and 0.33 (df=60, p<0.01), respectively.

DISCUSSION

In the present group of Gulf War veterans, the overall severity of PTSD symptoms, as measured by both the Mississippi scale and the DSM-III-R-based PTSD scale, increased in severity over 2 years. The greatest change occurred between 1 month and 6 months. This was consistent with the pattern seen in individual symptoms; i.e., most of the change was observed between 1 month and 6 months. Clinically, it appears that for the group as a whole most PTSD-specific symptoms had already developed by 6 months.

The mean total Mississippi scale and PTSD scale scores significantly differed between the medical and military police units at 2 years but not at 1 month or 6 months. Moreover, the change in total Mississippi scale score over time significantly differed between the two

units. It appears that after the 6-month evaluation the level of symptoms continued to increase in the medical unit, whereas it stabilized, or perhaps decreased slightly, in the military police unit.

The subjects who dropped out of the medical unit before the 2-year evaluation were more symptomatic than those who dropped out of the military police unit. Although this difference in symptoms was not statistically significant, it may suggest that the observed difference between severity of symptoms in the two units at 2 years would actually have been greater had the 22 noncompleters remained in the study. The mean Mississippi scale score at 2 years for the medical unit completers is probably an underestimate, while the mean for the military police unit is probably an overestimate. Furthermore, the correlation between traumatic exposure as measured by the Desert Storm trauma questionnaire and level of symptoms as measured by the Mississippi scale was statistically significant at 2 years, suggesting that it may take time for the consequences of traumatic exposure to become apparent.

Retrospective studies (2) have also shown a positive relationship between symptom severity and degree of traumatic exposure 10 to 15 years after the trauma. The current findings suggest that this association may not be present initially but, instead, can develop gradually over time. Clinically, then, a high degree of combat exposure may be important in predicting the eventual development of symptoms. The essential question for future research is whether subjects who have low levels of PTSD symptoms at early screenings but have high levels of traumatic exposure can benefit from timely therapeutic intervention.

Little is known about the order of PTSD symptom development. In the current study, scores for the hyperarousal symptom cluster were significantly higher than those for the reexperiencing and avoidance clusters at 1 month, 6 months, and 2 years after the war. This suggests that hyperarousal is not a response to reexperiencing or avoidance and that it more likely develops at or near the time of the trauma. Whether persistent hyperarousal eventually leads to reexperiencing and avoidance is a subject for further research.

Three of the four most frequently endorsed symptoms (startle, sleep disturbance, and irritability) were from the hyperarousal cluster. The central importance of disturbed arousal in patients with PTSD has been described for victims of industrial accidents (17), brush fires (7), and combat (18, 19). In fact, McFarlane (7) found that symptoms of attention and arousal were far better at discriminating between brush fire victims with and without PTSD than were symptoms of reexperiencing.

The number of reservists who met the diagnostic criteria for PTSD was relatively small. However, with a cutoff score of 89 on the Mississippi scale, the subjects who had PTSD at 1 or 6 months continued to meet the criteria at 2 years. That is, if a subject had developed PTSD by the 6th month, the disorder had not remitted at 2 years. Similarly, for three of the four subjects who met the criteria according to the DSM-III-R PTSD scale at 1 month, the disorder did not remit by 2 years.

The reported number of subjects who met the criteria for PTSD in this study is probably an underestimate for two reasons. First, 12 of the 62 subjects requested and received treatment in our outpatient PTSD clinic. According to a consensus diagnostic team, nine of the 12 met the DSM-III-R criteria for PTSD. However, only eight of the nine had a Mississippi scale score of 89 or greater, suggesting that some subjects underreported the degree of symptoms on self-administered inventories. Second, five (23%) of the 22 dropouts met the DSM-III-R criteria for PTSD at either 1 month or 6 months, a higher prevalence than that observed in the completers at the same time points.

Since this is a follow-along study, the limitations described in the preliminary report (14) still apply. These include problems associated with an incomplete study group, reliance on self-rated questionnaires, and a tendency for subjects to underreport symptoms. Some minor discrepancies between the results of the preliminary report and those described here may be attributed to the fact that 22 of the 84 who completed the assessments at the first two time points did not participate in the 2-year follow-up. Not only is the study group reduced, but also the dropouts as a group appear to be more symptomatic that those who continued in the study.

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